CLAIMS

1. A flame-sprayed copper-aluminum composite material, which comprises copper or a first copper alloy having at least an unmelted phase, and aluminum or a first aluminum alloy having at least a melted phase.

2. A flame-sprayed copper-aluminum composite material according to claim 1, wherein said first copper alloy comprises a second copper alloy, which is formed by incorporating said aluminum or a component of the first aluminum alloy into the first copper alloy, by flame-spraying.

3. A flame-sprayed copper-aluminum composite material according to claim 1 or 2, wherein said first aluminum alloy comprises a second aluminum alloy, which is formed by incorporating said copper or a component of the first copper alloy into the first aluminum alloy, by to flame-spraying.

4. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 3, characterized in that the main structure consists of the unmelted phase of the copper or the first copper alloy and the melted phase of aluminum or the second aluminum alloy.

5. A flame-sprayed copper-aluminum composite material according to claim 4, wherein said flame-sprayed layer surface comprises at least either of the melted phase of copper or the first copper alloy and the melted phase of the first aluminum alloy.

6. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 5, wherein said first copper alloy comprises Pb, and said first aluminum alloy comprises Si.

7. A flame-sprayed copper-aluminum composite meterial according to claim 6, characterized in that said first copper alloy comprises 40% by weight or less of Pb, and said first aluminum alloy comprises from 12 to 60% by weight of Si.

8. A flame-sprayed copper-aluminum composite material according to claim 7, characterized in that said first copper alloy contains from 0.5 to 50% by weight of one or more selected from the group consisting of 30% by weight or less of Sn, 0.5% by weight or less of P, 15% by weight or less of Al, 10% by weight or less of Ag, 5% by weight or less of Mn, 5% by weight or less of Cr, 20% by weight or less of Ni, and 30% by weight or less of Zn.

9. A flame-sprayed copper-aluminum composite material according to claim 7, characterized in that said first aluminum alloy further comprises 30% by weight or less of Sn.

10. A flame-sprayed copper-aluminum composite material according to

claim 7, characterized in that said first aluminum alloy further comprises at least one element of the group consisting of 7.0% by weight or less of Cu, 5.0% by weight or less of Mg, 1.5% by weight or less of Mn, 1.5% by weight or less of Fe, 8% by weight or less of Cr, and 8.0% by weight or less of Ni.

11. A flame-sprayed copper-aluminum composite material according to claim 10, characterized in that said first aluminum alloy further comprises 30% by weight or less of Sn.

12. A flame-sprayed copper-aluminum composite material according to claim 8, characterized in that said first aluminum alloy further comprises 30% by weight or less of Sn.

13. A flame-sprayed copper-aluminum composite material according to claim 8, characterized in that said first aluminum alloy further comprises at least one element of the group consisting of 7.0% by weight or less of Cu, 5.0% by weight or less of Mg, 1.5% by weight or less of Mn, 1.5% by weight or less of Fe, 8% by weight or less of Cr, and 8.0% by weight or less of Ni.

14. A flame-sprayed copper-aluminum composite material according to claim 13, characterized in that said first aluminum alloy further comprises 30% by weight or less of Sn.

15. A flame-sprayed copper-aluminum composite material according to claim 7, characterized in that the entire composition is Cu: 8 – 82% by weight, Al: 5 – 50% by weight, Pb: 32% by weight or less, and Si: 5 – 50% by weight.

16. A flame-sprayed copper-aluminum composite material according to claim 8, characterized in that the entire composition is Cu: 8 – 82% by weight, Al: 5-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, Sn: 24% by weight or less, P: 0.4% by weight or less, Ag: 8% by weight or less; Mn: 4% by weight or less, Cr: 4% by weight or less, Ni: 16% by weight or less, and Zn: 24% by weight or less.

17. A flame-sprayed copper-aluminum composite material according to claim 9, characterized in that the entire composition is Cu: 8-82% by weight, Al: 5-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, and Sn: 21% by weight or less.

18. A flame-sprayed copper-aluminum composite material according to claim 10, characterized in that the entire composition is Al: 15-50% by weight, Cu: 8-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, Mn: 1.2% by weight or less, Cr: 5% by weight or less, Ni: 4% by weight or less, Mg: 4.0% by weight or less, and Fe: 1.2% by weight or less.

19. A flame-sprayed copper-aluminum composite material according to

claim 11, characterized in that the entire composition is Al: 15-50% by weight, Cu: 8-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, Sn: 24% by weight or less, Mn: 1.2% by weight or less, Cr: 5% by weight or less, Ni: 4% by weight or less, Mg: 4.0% by weight or less, and Fe: 1.2% by weight or less.

20. A flame-sprayed copper aluminum composite material according to claim 12, characterized in that the entire composition is Al: 15-50% by weight or less, Cu: 8-50% by weight or less, Pb: 32% by weight or less, Si: 5-50% by weight, Sn: 30% by weight or less, Mn: 4% by weight or less, Cr: 4% by weight or less, Ni: 16% by weight or less, and Zn: 24% by weight or less.

21. A flame-sprayed copper-aluminum composite material according to claim 13, characterized in that the entire composition is Al: 15 – 50% by weight, Cu: 8-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, Sn: 24% by weight or less, P: 0.4% by weight or less, Ag: 8% by weight or less, Mn: 5% by weight or less, Cr: 8% by weight or less, Ni: 20% by weight or less, Zn: 24% by weight or less, Mg: 4.0% by weight or less, and Fe: 1% by weight or less.

22. A flame-sprayed copper-aluminum composite material according to claim 14, characterized in that the entire composition is Al: 15-50% by weight, Cu: 8-50% by weight, Pb: 32% by weight or less, Si: 5-50% by weight, Sn: 30% by weight or less, P: 0.4% by weight or less, Ag: 8% by weight or less, Mn: 5% by weight or less, Cr: 8% by weight or less, Ni: 20% by weight or less, Zn: 24% by weight or less, Mg: 4.0% by weight or less, and Fe: 1% by weight or less.

23. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 22, wherein at least a portion of said first copper alloy (except for the second copper alloy) consists of Cu crystals, and at least a portion of said first aluminum alloy (except for the second aluminum alloy) consists of Al crystals.

24. A flame-sprayed copper-aluminum composite material according to any one of claims 6 through 23, characterized by further containing 30% by weight or less of graphite particles.

25. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 24, characterized by further containing 30% by weight or less of one or more selected from the group consisting of Al_2O_3, SiO_2, SiC, ZrO_2, Si_3N_4, BN, AlN, TiN, TiC, B_4C, as well as iron-phosphorus, iron-boron, and iron-nitrogen compounds.

26. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 25, wherein it is laminated on a substrate and is coated with a soft metal layer.

27. A flame-sprayed copper-aluminum composite material according to claim 26, wherein said soft metal layer is a plating layer of Pb, Pb alloy, Sn or Sn alloy.

28. A flame-sprayed copper-aluminum composite material according to claim 26, wherein said soft metal layer is a plating layer mainly consisting of Pb and Sn.

29. A flame-sprayed copper-aluminum composite material according to any one of claims 1 through 25, characterized in that said flame-sprayed surface layer is coated with a film, which comprises MoS_2 or graphite or a mixture of MoS_2 and graphite.

30. A method for producing a copper-aluminum composite material, characterized in that powder of copper or copper alloy and powder of aluminum or aluminum alloy are flame-sprayed in such a manner that a portion of these powders is melted and a portion is not melted.

31. A method for producing a copper-aluminum composite material according to claim 30, characterized in that the main structure of the copper-aluminum composite material is combination of one or more of (a) melted structure of copper or copper alloy, (b) unmelted structure of copper or copper alloy, (c) melted structure of aluminum or aluminum alloy, and (d) unmelted structure of aluminum or aluminum alloy (except for the combination of only (a) and (c) and only (b) and (d)).

32. A method for producing a copper-aluminum composite material according to claim 30 or 31, wherein said copper alloy is Cu-Pb based alloy, and said aluminum alloy is Al-Si based alloy.

33. A method for producing a copper-aluminum composite material according to any one of claims 30 through 32, characterized by further flame spraying 30% by weight or less of graphite powder.

34. A method for producing a copper-aluminum composite material according to any one of claims 30 through 33, characterized by further flame spraying 30% by weight or less of one or more selected from the group consisting of Al_2O_3, SiO_2, SiC, ZrO_2, Si_3N_4, BN, AlN, TiN, TiC, B_4C, as well as iron-phosphorus, iron-boron, and iron – nitrogen compounds.

35. A method for producing a copper-aluminum composite material according to any one of claims 30 through 34, wherein the flame spraying is carried out on a roughened surface of a metallic substrate.

36. A method for producing a copper-aluminum composite material according to any one of claims 30 through 34, wherein heat treatment of the flame-sprayed layer is carried out subsequent to the flame spraying.